

**Abstract**

Novel gas separation apparatus and methods are provided that help reduce the amount of process gas lost through the discharge outlet of either a cyclone separating gas/solid mixtures or a hydroclone separating gas/liquid mixtures. Significant savings are realized by minimizing losses and neutralization costs. A cyclone or hydroclone is placed within a containment vessel that creates a contained atmosphere common to both the gas outlet and the discharge outlet of the cyclone or hydroclone. Process gas mixed with the solids or mixed with the liquids in the discharge underflow are displaced from the discharge underflow and contained within the containment vessel. The displacement of the process gas is facilitated by an introduction of a small amount of purge gas to the discharge underflow exiting the cyclone or hydroclone via the discharge outlet. The mixture of displaced process gas and purge gas migrates to the top of the containment vessel where it is merged with the gas overflow exiting the cyclone or hydroclone via the gas outlet.